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37. Как получили невероятные ракурсы в открытом космосе, если астронавт висел неподвижно в павильоне? Разгадка Джемини. Часть 7.

14-17 minutes

We continue to discuss the first spacewalk by American astronaut Edward White. Allegedly, this event took place in June 1965, 2.5 months after Alexei Leonov (USSR). It is quite obvious to us that this is a video of a "space walk",Ed White's Spacewalk on Gemini 4 Enhanced , 8 min 55 sec duration, filmed entirely in the pavilion. And instead of the astronaut, the actor hung motionless on the cable, only occasionally moving his arms. For many viewers, at the first viewing, it seems inexplicable how you can hang on a rope and at the same time turn in different directions - after all, we see a person dressed in an astronaut's suit from the side, then from below, then from above.

Some fragments of the astronaut's "flight".

A few years ago, I would have spent a lot of effort to convincingly explain how you can get such unusual angles from a completely motionless actor. But not so long ago, an inexpensive item appeared, with the help of which all this can be shown in an elementary simple way. It's a selfie stick!

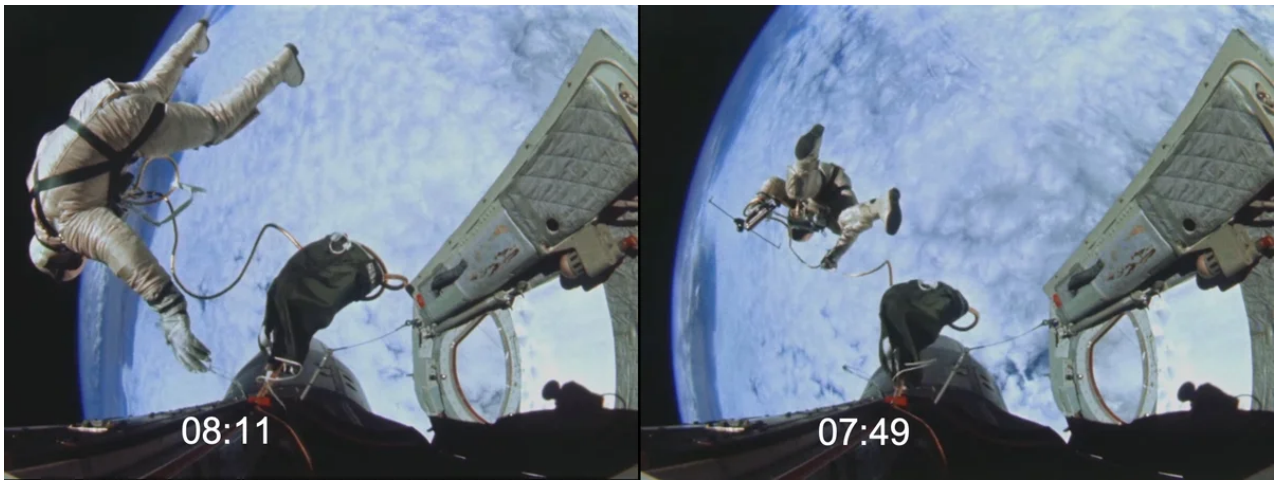
So the girl decided to fly with an instructor on a paraglider and took a selfie stick to her cell phone for filming. A paraglider is an aircraft based on a parachute in the form of a wing. During the flight, the girl filmed a video, now raising and lowering this selfie stick. And here are the angles she got: there are shots when the girl is visible from the front, from the side, from above and even from below. The frames were taken from the channel "Paragliding around the world ".

Here's a shot from the front and a shot from the side.

And here is the top view and the bottom view.

And this despite the fact that the girl with the instructor hung motionless on the parachute lines. I "estimated" the distance from the girl's face to the fist with which she was gripping the end of the selfie stick on her outstretched hand. It turned out about 60 cm.And a selfie stick - another 50-60 cm.Thus, to get a lower angle with legs or two figures from above, it was enough to lower the cell phone (or a video camera like go-pro) 1.2 m down or raise it 1.2 m up. Thanks to the wide-angle lens, with a small change in distance, it was possible to get very different angles.

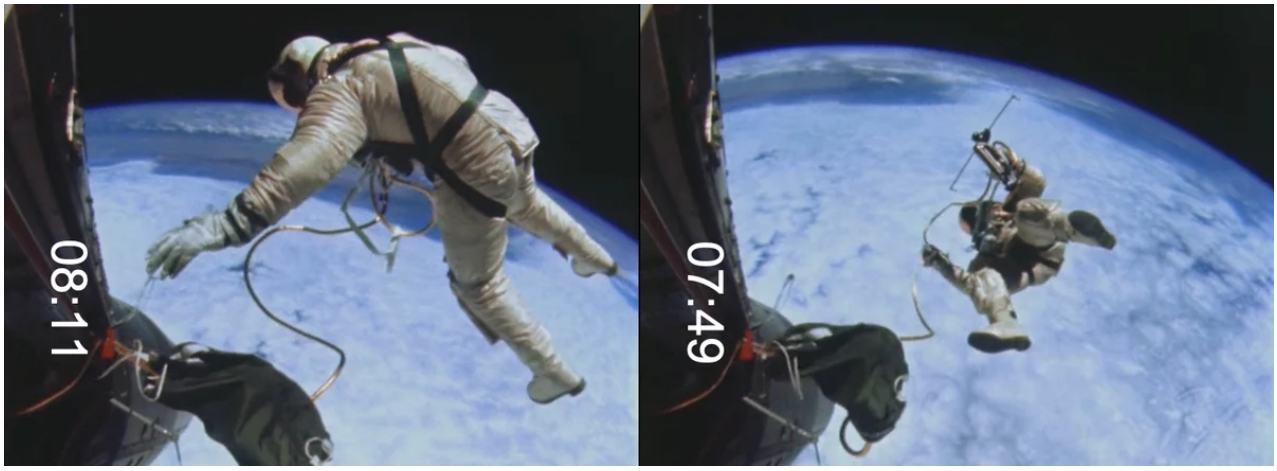
In the same way, different angles were obtained in the case of Gemini 4. The actor, depicting the astronaut, hung motionless, and the camera that filmed him, then went up, showing the back and helmet (frame on the left), then went down, filming from the bottom of his legs (frame on the right).



The first appearance of an astronaut in the frame.

In the case of the girl, we understand that she was hanging with her feet down all the time, and that we just have different angles in front of us. The changing background speaks of the foreshortenings - it is white clouds in the sky, then a green field below, then a red parachute wing. But the girl herself did not roll over relative to the parachute lines.

So in "Gemini-4" - the astronaut did not change his position in relation to the anchorage ropes, he was hanging with his feet down all the time. Since we know that the shooting was done with a movie camera turned to its side by about 90 degrees, in reality these two frames of the first appearance of the astronaut (at 8:11 and 7:49) looked like in the picture below.



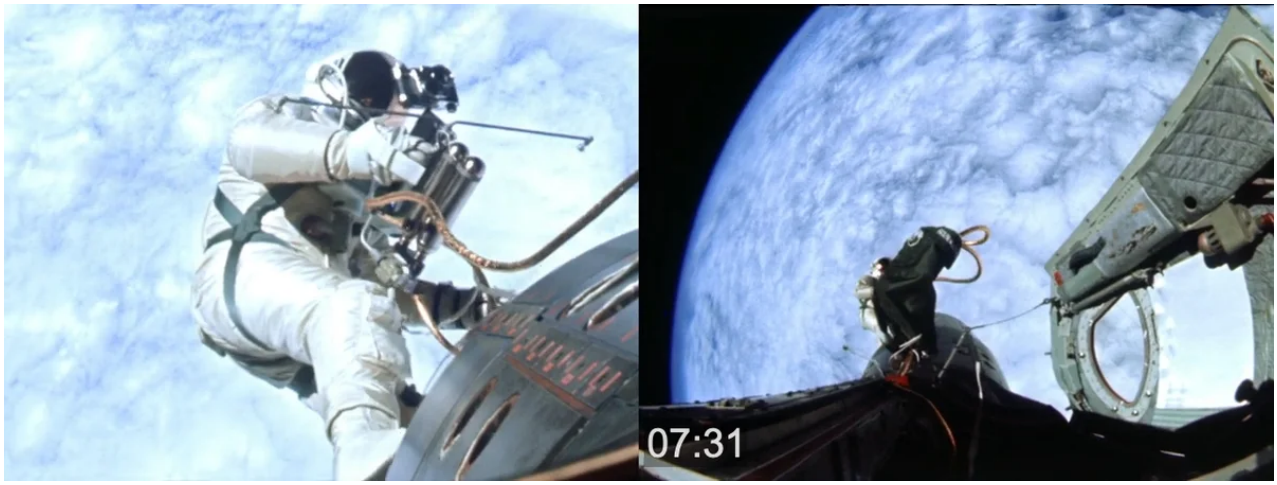
Top view (left) and bottom view (right). The astronaut hangs with his feet down all the time.

And the trick of filming was that, together with the movement of the camera up and down in the pavilion, the background movie screen was synchronously moved, where the cloud cover of the Earth was projected. He remained in the same place with respect to the shooting camera all the time. The camera moved, the background moved in sync, and the actor remained in place.

An ultra-wide-angle lens was used to create the illusion of a long distance away. Without this lens, we would be surprised to find that the maximum distance is only 1 meter from the bow of the ship. We found a shot where the astronaut figurine looks at the smallest scale. This happened at the moment when the astronaut partially disappeared behind the nose of the capsule. Since there is a video taken from a different point (as if from a different hatch), it is clear that at this moment the astronaut gently touches the apparatus with the toe of his boot.

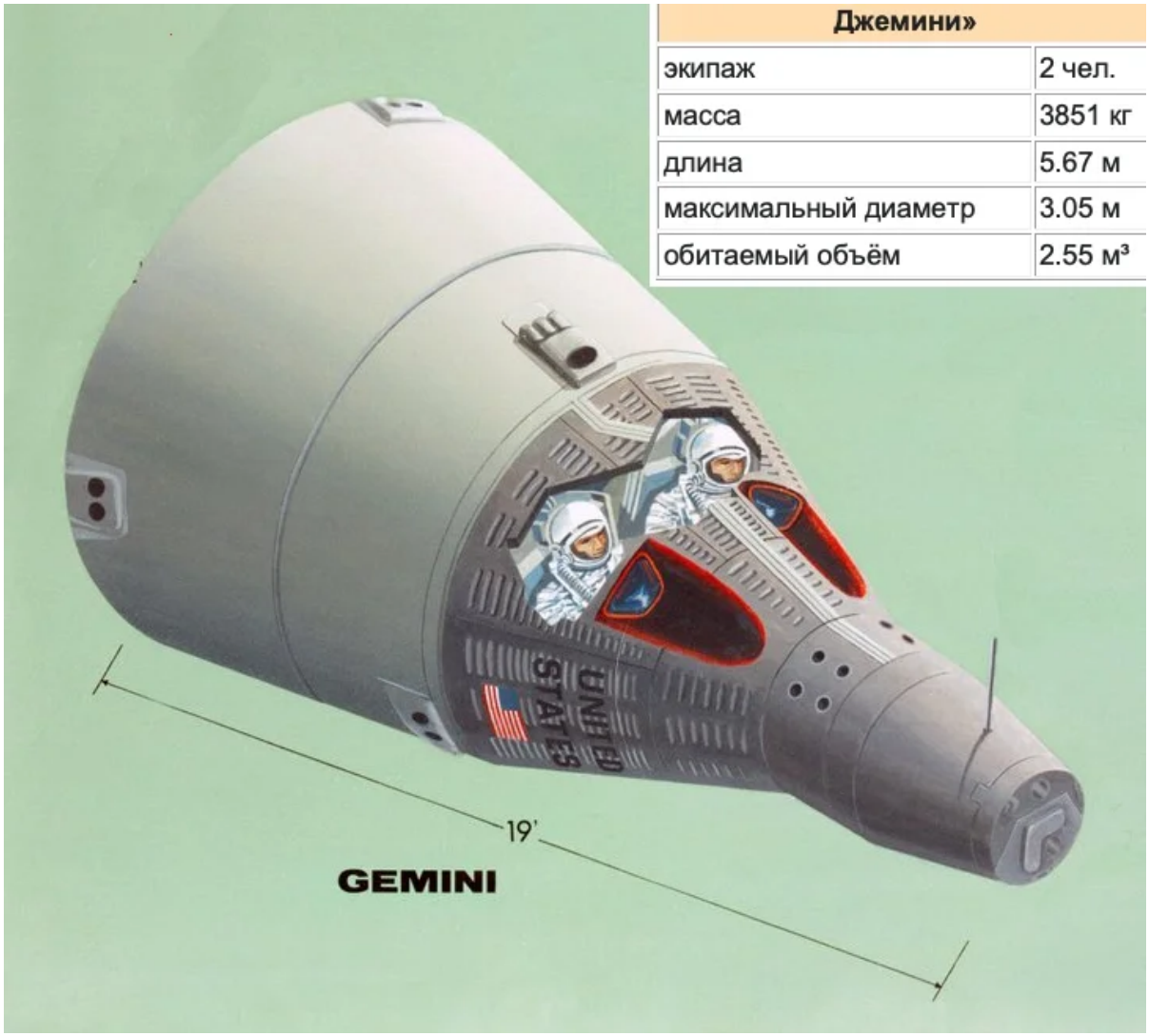
Here is a video uploaded to U-Tub.

And here is the shot where the astronaut touches the surface of the capsule with his foot (this can be clearly seen in the video). This is the maximum removal. I "experimented" with a tape measure - the distance from the nose of the capsule to the edge of the back is no more than 1 meter. From here it is easy to determine the maximum distance of the astronaut from the shooting camera.



Kicks off the capsule nose.

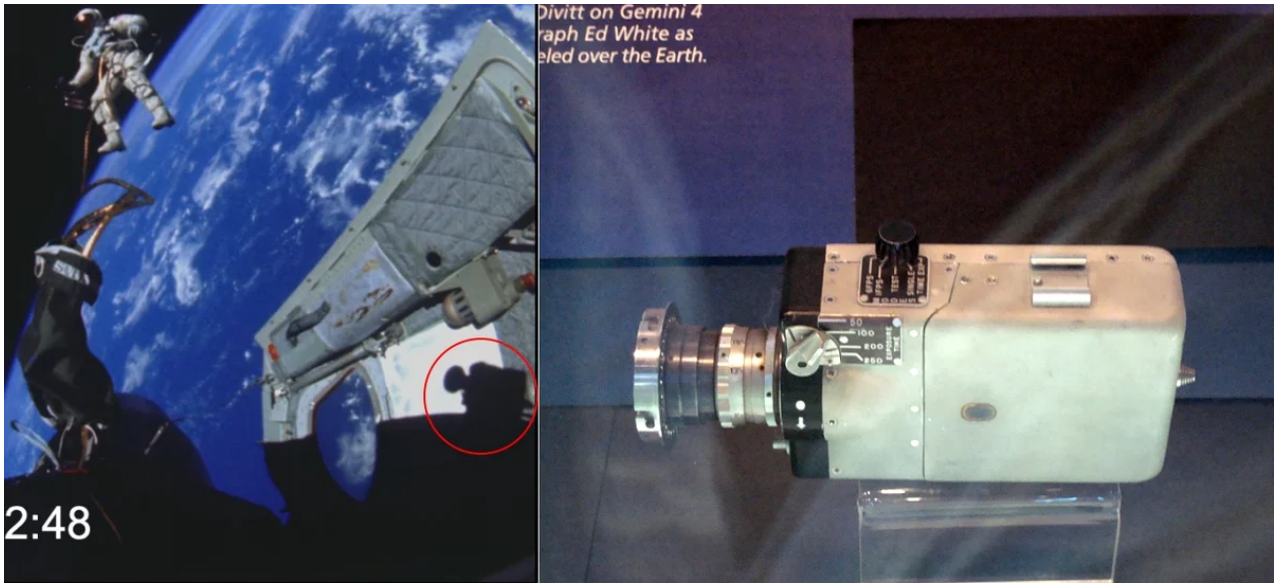
The Gemini's length is 19 feet, or 19 x 0.3048 = 5.79 m. According to other sources (from Wikipedia) - 5.67 m. The difference is small, so let's take an average of 5.7 m.



Джемини»	
экипаж	2 чел.
масса	3851 кг
длина	5.67 м
максимальный диаметр	3.05 м
обитаемый объём	2.55 м³

Gemini sizes.

A shadow from a movie camera appears on the hatch door. According to official data, this is 16 mm "a data collection camera "by Maurer, which is equipped with a wide-angle lens. The Apollo missions used the same 16-mm film camera with a focal length of 10 mm."

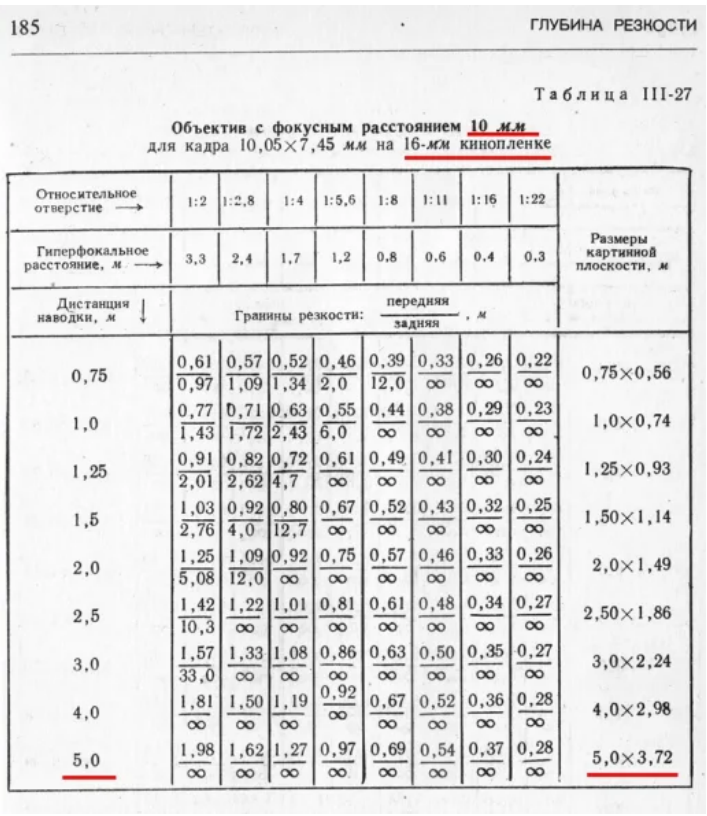


Movie camera "Maurer", which was used in the mission "Gemini 4".

From the shadow of the movie camera, you can determine its location on the surface of the capsule and calculate the maximum distance the astronaut has moved away from the camera. From the camera attachment point to the end of the capsule nose is 3.5 meters, which means that the maximum distance will be 4.5 meters.

But from this distance, the figure of the astronaut on the "10 mm" lens should occupy half of the frame in height, if the astronaut is facing the camera without tilting in depth. And in the frame, we see that the figure is less than 1/3 of the frame in height.

I took the "Cameraman's Handbook" and looked at what the size of the picture plane should be for a lens with a focal length of 10 mm.



185 ГЛУБИНА РЕЗКОСТИ

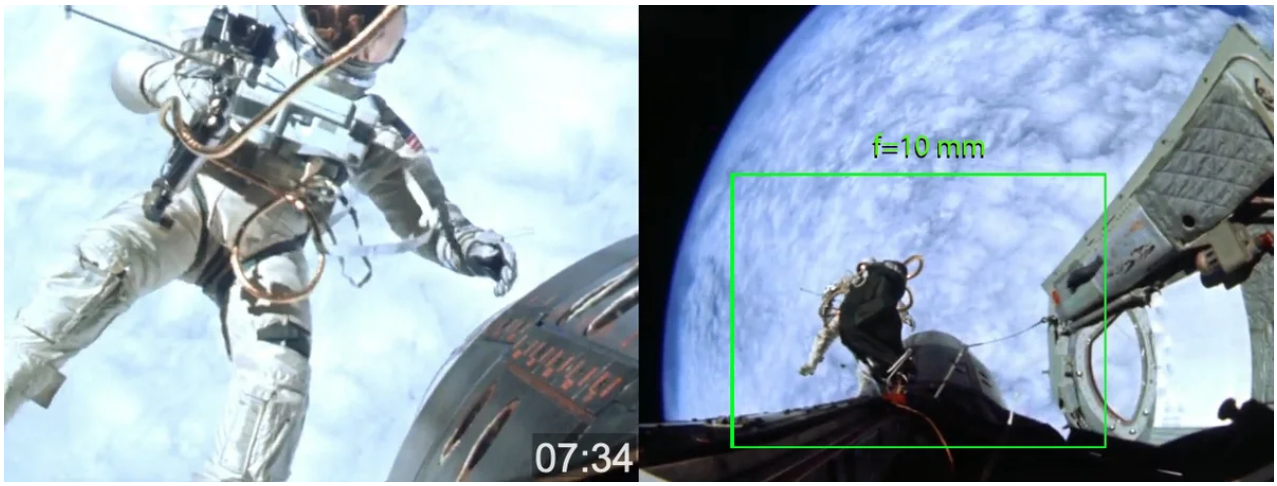
Таблица III-27

Объектив с фокусным расстоянием 10 мм
для кадра 10,05×7,45 мм на 16-мм кинопленке

Относительное отверстие →	1:2	1:2,8	1:4	1:5,6	1:8	1:11	1:16	1:22	
Гиперфокальное расстояние, м →	3,3	2,4	1,7	1,2	0,8	0,6	0,4	0,3	Размеры картинной плоскости, м
Дистанция наводки, м ↓	Границы резкости: передняя / задняя, м								
0,75	0,61 / 0,97	0,57 / 1,09	0,52 / 1,34	0,46 / 2,0	0,39 / 12,0	0,33 / ∞	0,26 / ∞	0,22 / ∞	0,75×0,56
1,0	0,77 / 1,43	0,71 / 1,72	0,63 / 2,43	0,55 / 6,0	0,44 / ∞	0,38 / ∞	0,29 / ∞	0,23 / ∞	1,0×0,74
1,25	0,91 / 2,01	0,82 / 2,62	0,72 / 4,7	0,61 / ∞	0,49 / ∞	0,41 / ∞	0,30 / ∞	0,24 / ∞	1,25×0,93
1,5	1,03 / 2,76	0,92 / 4,0	0,80 / 12,7	0,67 / ∞	0,52 / ∞	0,43 / ∞	0,32 / ∞	0,25 / ∞	1,50×1,14
2,0	1,25 / 5,08	1,09 / 12,0	0,92 / ∞	0,75 / ∞	0,57 / ∞	0,46 / ∞	0,33 / ∞	0,26 / ∞	2,0×1,49
2,5	1,42 / 10,3	1,22 / ∞	1,01 / ∞	0,81 / ∞	0,61 / ∞	0,48 / ∞	0,34 / ∞	0,27 / ∞	2,50×1,86
3,0	1,57 / 33,0	1,33 / ∞	1,08 / ∞	0,86 / ∞	0,63 / ∞	0,50 / ∞	0,35 / ∞	0,27 / ∞	3,0×2,24
4,0	1,81 / ∞	1,50 / ∞	1,19 / ∞	0,92 / ∞	0,67 / ∞	0,52 / ∞	0,36 / ∞	0,28 / ∞	4,0×2,98
5,0	1,98 / ∞	1,62 / ∞	1,27 / ∞	0,97 / ∞	0,69 / ∞	0,54 / ∞	0,37 / ∞	0,28 / ∞	5,0×3,72

The dimensions of the picture plane (underlined with a red line) for a 10 mm lens.

The handbook contains data for the aiming distance of 4.0 and 5.0 meters. Accordingly, at a distance of 4.5 meters, the lens will cover a 4.5 x 3.35 meter rectangle. If the astronaut is 4.5 meters away, then at this distance the height of the frame will be 3.35 m. Half of the frame in height is 1.68 m. But can't the height of an astronaut in a spacesuit be less than 1.68 m?



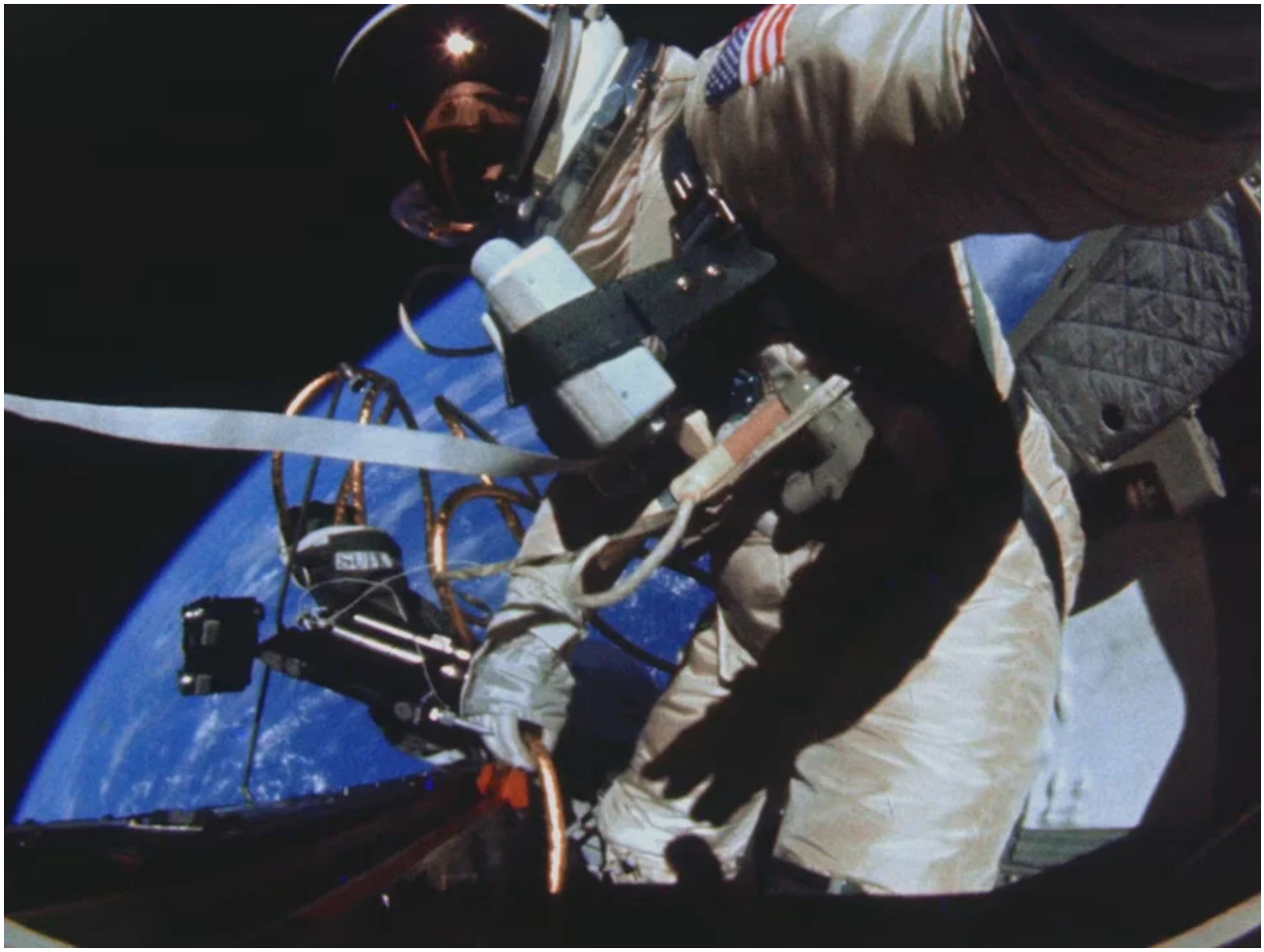
The "10mm" lens must cover the area marked with the green rectangle.

It turns out that the shots with the astronaut were taken with a lens with a shorter focal length. Of the existing lenses for 16 mm cinema cameras, a lens with a focal length of 5.7 mm is suitable for such an angle of coverage. This ultra-wide angle lens was used to create the illusion that the astronaut was far away from the capsule.

During the discussion of the article, Sergey Shingarev found information that when shooting this scene, a lens with a focal length of 5 mm was used. And he promised to find a photo of this lens. Since this is an ultra-wide angle lens, it should therefore have a strongly convex negative lens in front for a large angle of coverage.

In our opinion, the position of the camera is indicated incorrectly. The shadow from the movie camera on the capsule door is the shadow from the fake movie camera. And the real movie camera was in a different place.

To turn on the movie camera, the astronaut seemed to stand on the seat of the chair, or rather, on the back of the chair. His knees are on the edge of the hatch. At the same time, the astronaut reaches out with his hand to the movie camera. But the arm is parallel to the hull of the spacecraft. The distance from the shoulder to the knee can never be less than 50 cm. This means that the camera lens is approximately 0.5 m above the capsule body.



The shadow of the astronaut's hand approaches the lens of the movie camera.

But there are no large protrusions in this place on the body. And the camera cannot be 0.5 meters high. Maurer is a small portable movie camera, its height is only 10 cm (more precisely 10.16 cm).

Here's a hand touched the lens, but it is raised too high.

A hand touched the lens.

It feels like the real shooting lens is below. And what is higher in the shadow is just a props. Therefore, the shadow from the camera is defiantly for a long time an eyesore to convince you that the shooting is done at 16 mm.

But why was it necessary to hide the real movie camera?

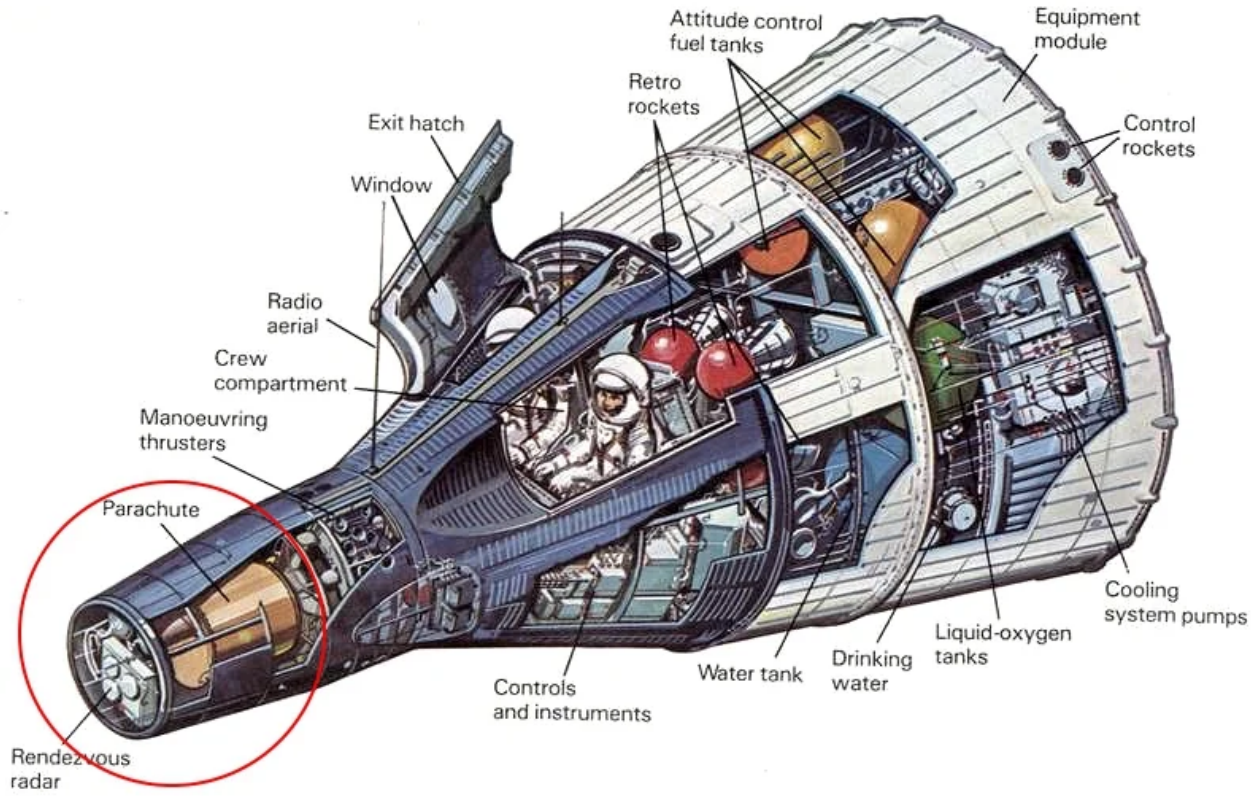
It is quite possible that the actual film camera was not 16mm, but used 35mm film. The fact is that the Hollywood workers understood that they had no right to show the ORIGINAL. After development, the cables are visible there. Therefore, the original will be photographed ONE-FRAME on a cartoon machine, and in each frame, where it is visible, the cable will be painted over. (Later I will definitely describe the technology of time-lapse shooting.) The new, corrected image will already be on another film. This will be a countertype. And when countertyping, the quality always deteriorates, especially on colored materials. The frame size on 16mm film is quite small, 10 x 7.45mm, and difficult to work with. (The film "2001. A Space Odyssey" was filmed on 70-mm film to obtain high quality.)

We are already approaching to draw the scheme according to which the shooting in the pavilion was carried out. We know the size of the capsule, we know the location of the camera, and we understand the maximum distance the astronaut was removed. True, you observed this distance with the "eyes" of an ultra-wide-angle lens, and therefore you got the wrong impression about the degree of distance.

This is how it might look from the outside if shot with a regular lens. In the museum, next to the Gemini capsule, there is a girl on the right, in the middle of the open hatch. It was from the position when the astronaut was in the middle of the hatch that the NASA video began.

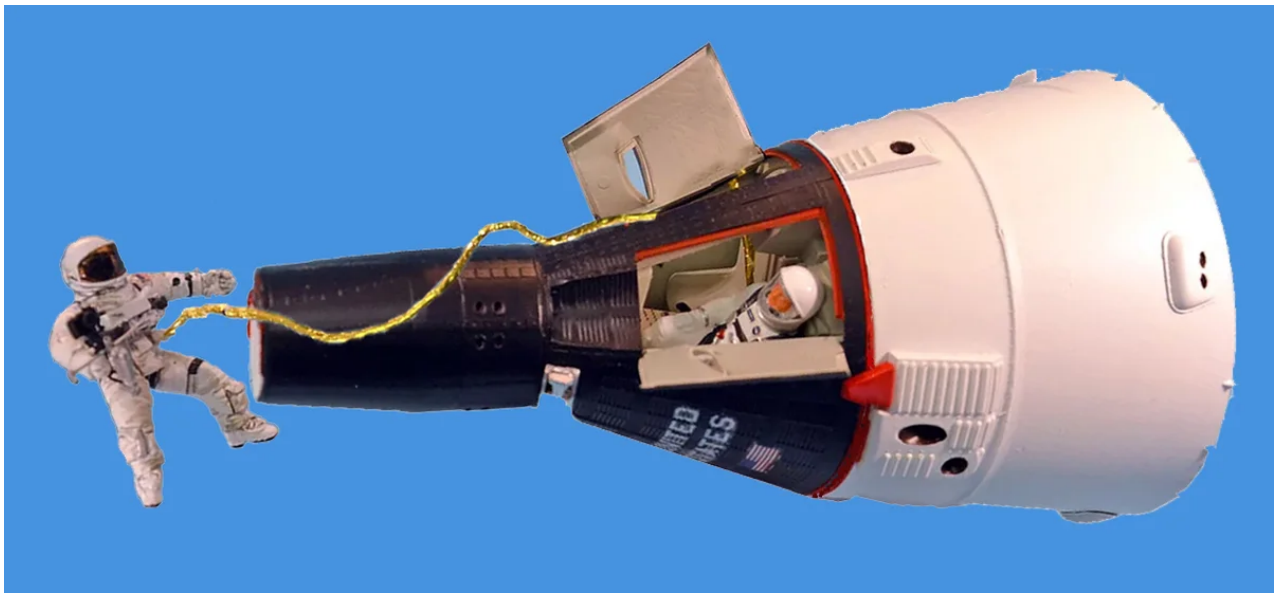
Gemini capsule in the museum.

And the maximum distance of the astronaut is 1 meter to the left from the capsule nose. Therefore, to represent the astronaut's extreme left position, add 1 meter to the left in the photo. Have you added? Place the astronaut there mentally. And now add about the same amount, 0.9-1 m, to the parachute compartment that has separated.



The parachute compartment is outlined in red.

These will be the limits beyond which the astronaut did not go.

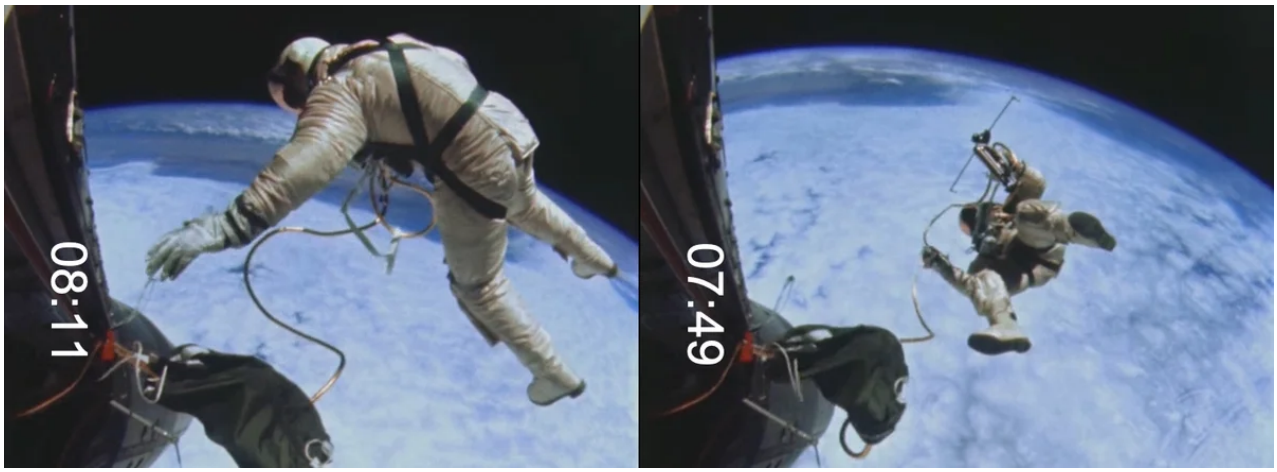


Maximum removal. Layout.

When the astronaut is in the frame as far away as possible (7:24), the capsule with the filming camera at that moment is directly below him. At the same time, the actor continues to hang on the rope without active movements.

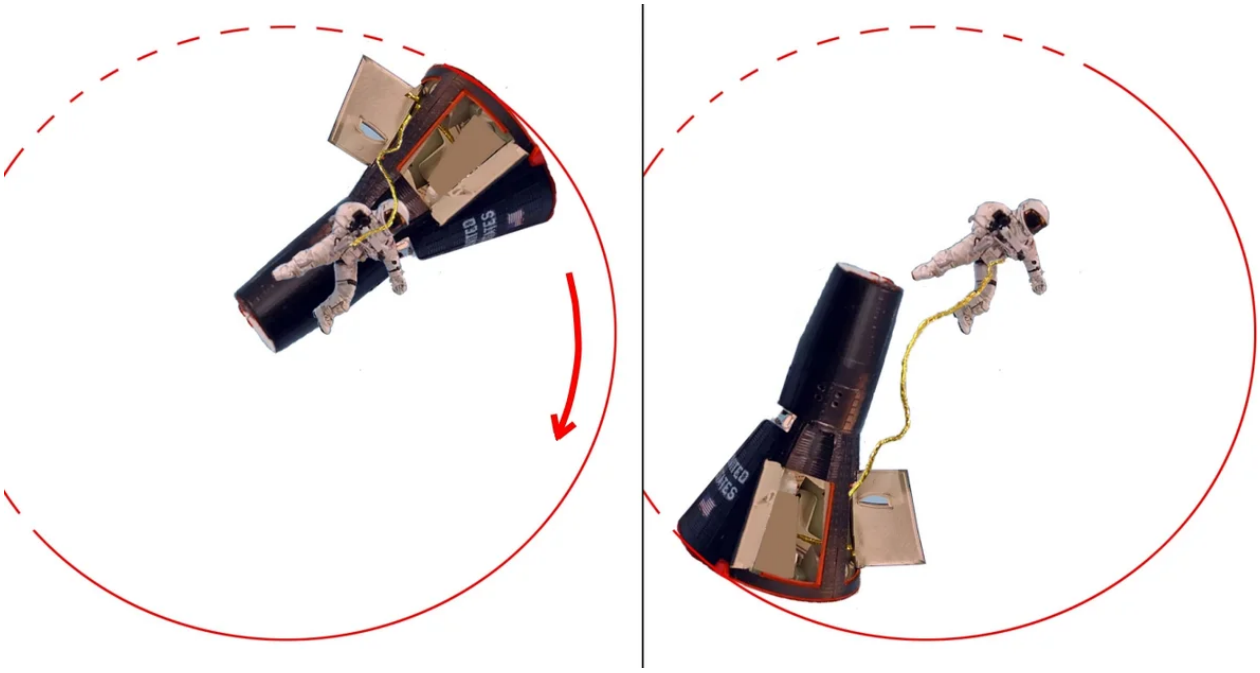
The actual location of the actor and capsule (left diagram) at 7:24 am (right).

And now we can trace the movement of the capsule's ~~selfie stick~~ in space, when the astronaut begins to appear in the frame for the first time. The NASA video, 8 minutes 55 seconds long, as you know from the previous parts, was launched by rewinding, and therefore begins in reality at 8:55, and the time on the frames goes down. After about 30 seconds of "blank" frame, at 8:25 am, the astronaut's arm and leg enters the frame. At 8:11, it appears in its entirety (frame on the left). We see his back, i.e. from above. After 22 seconds, we see it from the lower angle (frame on the right).



The astronaut is filmed first from above (8:11) and then from below (7:49).

Since we know that the actor portraying the astronaut was hanging in the pavilion with his feet down and almost motionless, the top view (at 8:11) and 22 seconds later the bottom view (7:49) was filmed as follows. A lightweight capsule (outer shell only) was attached to a large drum and rotated in a circle. We wrote in detail about such decorative drums rotating around a circle in part 4 of our research "Rotary decoration for zero gravity, or the solution to Gemini 4. At first, the capsule hovered over the astronaut (picture on the left), and after 22 seconds, having rotated half a circle, it turned out to be below.

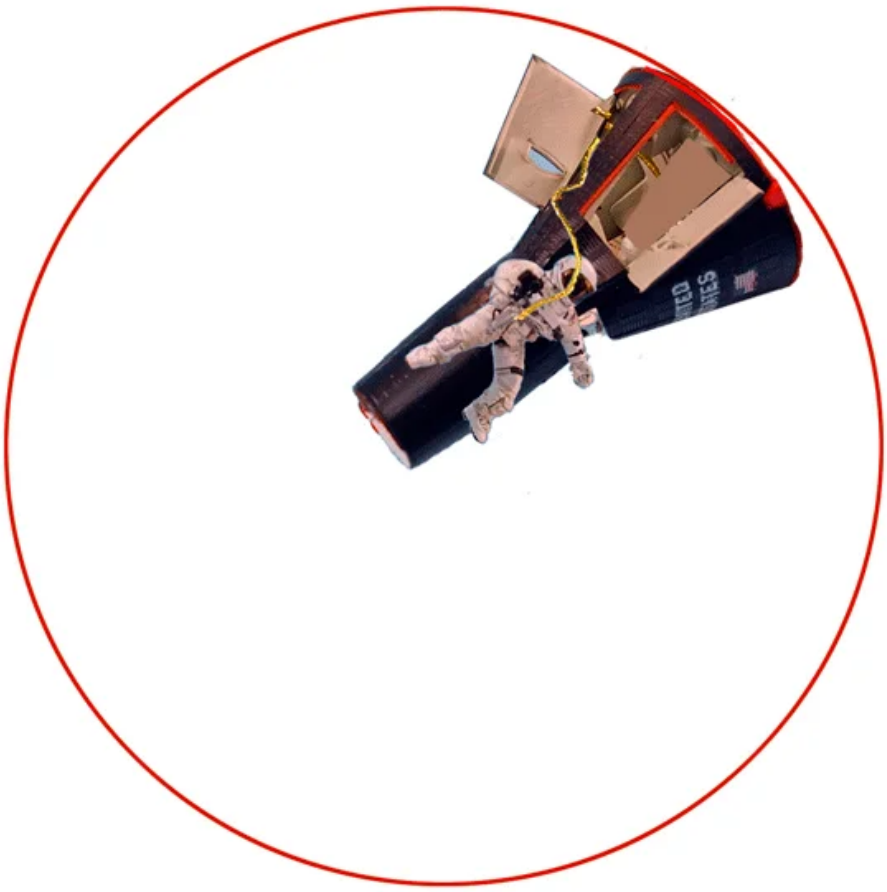


The position of the capsule at the beginning (left) and at the end (right).

The decrease in the apparent size of the astronaut was not due to the fact that he was moving away from the camera,

Reducing the apparent size of the astronaut.

and because of this, it hung not in the center of the axis of rotation of the drum. Therefore, in the beginning, the capsule with the filming camera was located close to it, and at the lowest point of the survey, this distance, from the camera to the astronaut, increased.



Gif file. Scheme of movement of a capsule with a filming camera in the time interval from 8:11 to 7:49.

So, taking the first one and a half minutes of NASA's video about the spacewalk of astronaut E. White (from 8:55 to 7:24), we came to the unequivocal conclusion that the entire video was filmed in the pavilion using cinematic techniques for simulating weightlessness. We have sequentially analyzed these film tricks: shooting in reverse (rewinding) -part 2 , shooting with an unusual camera position -part 3 , using turntable decorations in a huge drum -part 4 , the reason for the strange movement of the ribbons -part 5 and deliberate shaking of the halyard -part 6 . In this, part 7, we showed the trajectory of the motion picture camera in a circle around a stationary astronaut to create the illusion of a somersault in zero gravity.

In the following parts, we will talk about what the astronaut was doing near the nose of the capsule and about the strange splicing in the middle of the plan. In addition, we will tell you where the movie screen was with the cloudy cover of the Earth, we will recreate on the model the turns of the huge drum together with the capsule and the rotation of the movie camera around its own axis.

Next, **part 8.** The answer to Gemini is at hand!

*

Cameraman L. Konovalov was with you. Until next time!

*

Previous parts:

Part 1. **How the spacewalk was filmed in the pavilion, or the solution to Gemini 4.**

Part 2. **Where the glove flies, or the solution to "Gemini 4".**

Part 3. **Somersault in zero gravity, or the solution to "Gemini-4".**

Part 4. **Rotary decoration for weightlessness, or "Gemini-4" solution.**

Part 5. **He turned the astronaut upside down and was dumbfounded. The answer to Gemini.**

Part 6. **Why did the astronaut tug on the halyard so hysterically? The answer to Gemini.**